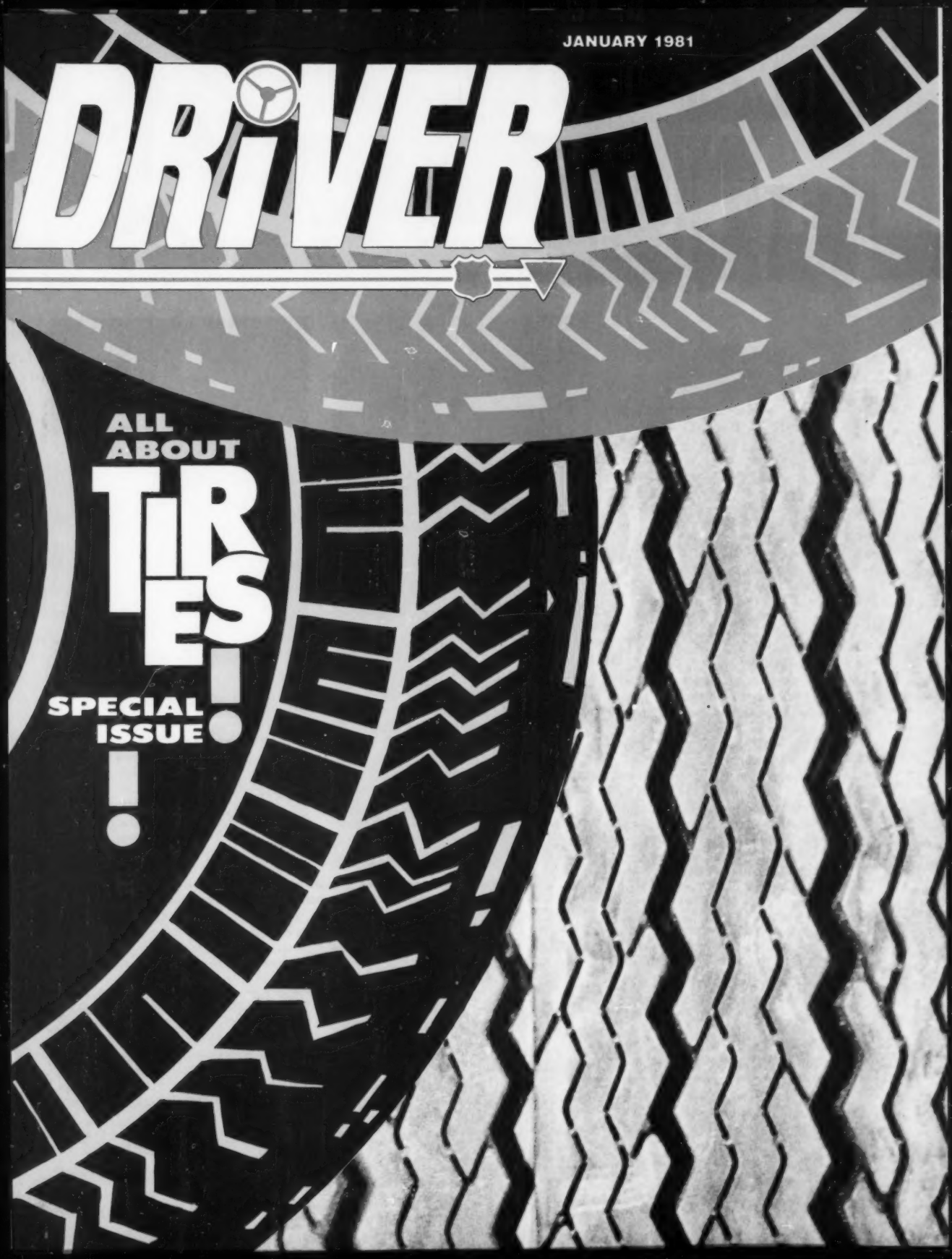
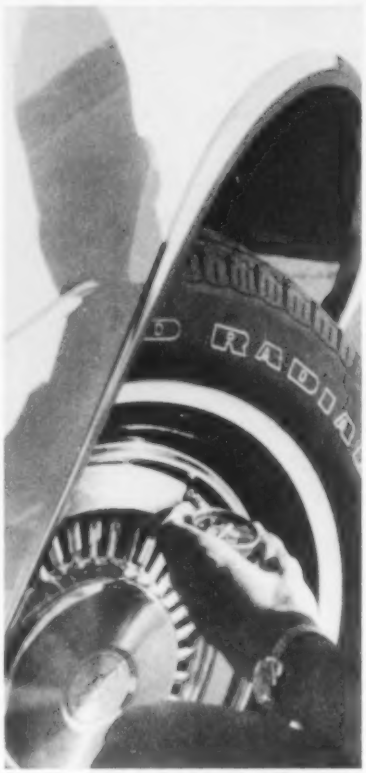

JANUARY 1981
DRIVER
ALL ABOUT
TIRES!
SPECIAL ISSUE!

DRIVER

GET NO RESPECT



(left) **Checking your tire pressures** is one of the safest things you can do. Be sure to check inflation pressures with a gauge at least once a month.(right) **Solid rubber bars** across a tire's tread indicate that it's time to replace the tire.

Tires, like Rodney Dangerfield and DRIVER's feature editor, get no respect. Many people think tires just support the vehicle at the corners. Others think they're designed to give a comfortable ride. But by their very nature tires are so important to the safety and performance of the automobile that they are second only to brakes in needing prime attention and care.

When a tire wears out, you don't just slap on a new one, give it a shot of compressed air, and expect it to run tens of thousands of miles without a whimper. However, in most cases new tires will do just that, so not all of us appreciate what a tire must go through to get the job done.

With the exception of a few car enthusiasts, most tire buyers know very little about the mechanics of tire performance. They depend on the tire dealer to guide them through what can be a confusing mass of information. They trust the dealer to provide them with the right tires for the job and the information needed to maintain them. Therefore, it is of the utmost importance that buyers carefully discuss some basic points with the dealer.

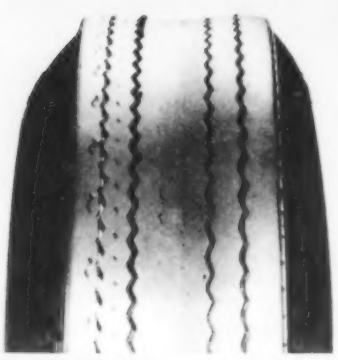
Different tires, of course, are designed for different applications. Some people are prone to choose tires according to current styles — and not safety. Daily we see examples of tires which are too large or too small for the loads they must carry, are an improper tread type, or that belong to the wrong class.

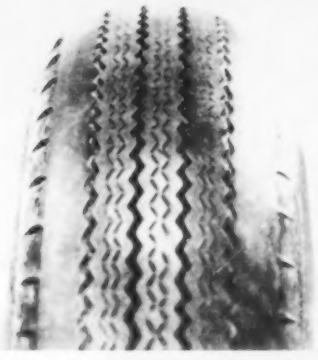
When a customer insists on a certain "look," a truly professional tire dealer will refuse the sale rather than install improper tires which may later cause an accident. Even if the customer is willing to accept the risk, the professional dealer will not mount the tires. Remember, the dealer not only has a responsibility to the customer but third parties that the customer might injure in a tire-caused or related accident. A truly professional tire dealer will always strive to protect customers from their own improper judgments.

Tires must be kept inflated at recommended air pressures in order to properly support the particular vehicle loads. The professional tire dealer must analyze the vehicle and its operating conditions, recommend the proper air pressure and caution the customer that routine checks with a gauge are necessary. Contrary to popular belief, no tire made is absolutely airtight. No tire and wheel assembly made is a perfect air seal, and over a period of time some air pressure will be lost. Punctures, no matter how small, may also result in slow leaks which may not be noticed right away.

Assuming that you don't need to check

BANG! BUMP! RIP!





(left) **Overinflation** causes tires to run hard and makes them vulnerable to impact damage and weakening of the carcass. It also causes improper wear in the center of the tread. (middle) **Underinflation** causes extreme tire flexing and builds up excessive heat, running the risk of sidewall failure. It also causes rapid wear on outer tread ribs. (right) **When the vehicle's front end** is out of alignment, tires wear irregularly, vibrate and steal mpg from your car as well as endanger you.

your tire air pressure is an invitation to disaster. Many people will say that they leave these checks to their tire dealers or mechanics as a part of routine service. This is a serious mistake because very few air pressure checks are made as a part of routine servicing. Many people also believe that such checks are needed only every 5,000 miles. This, too, is a serious mistake. Check tire air pressure at least every time you fill the gas tank.

Tires must be continually inspected for road damages. Probably no other part of a car is exposed to more abuse during normal operation; there is routine contact with foreign objects, potholes and numerous other hazards. Tires are also affected by severe heat, chemical exposure, abnormal use and age. Damage to tires, even though seemingly small at the time, can cause later failure, loss of control and accidents.

If tires stayed perfectly round throughout each cycle they turn we probably wouldn't have half the problems. But they don't. The point where the tire touches the ground forms the footprint (also called contact area or patch area). Because the tire's diameter is less at this point and it only has an effect on the tire during vehicle movement, it is called the rolling diameter. The tire's other diameter is called the free diameter, or that diameter that is free of any load. The footprint therefore represents the tire's deflection from free to rolling diameter.

Vehicle load is proportional to deflection, with greater loads causing greater deflection. Deflection would cause very rapid tread wear if it weren't for tread grooves that provide room for the tread material to be "taken up" as it passes through the deflected portion.

Overloading a vehicle by using tires that are too small to support the weight of the vehicle, or under-inflating the tires increases deflection until the center of the tread is raised off the road surface causing rapid wear of the tread at its outer edges.

Overinflation causes just the opposite wear pattern. Deflection is decreased until only the center of the tread contacts the road surface. This permits a rapid wearing of the center area tread material.

Consequently, tread mileage is substantially increased by maintaining recommended tire inflation pressures at all times. While that may be "old" news, it is still of primary importance.

Most experts recommend adding air to the tires as vehicle loads increase to compensate for possible overdeflection. And all experts agree that air should never be bled from hot tires to bring inflation pressure down to "cold" specifications. It's not unusual for tire air pressure to increase as much as eight pounds per square inch (psi) after a high-speed run with heavy loads.

Check pressure when tires are cold. For inflation purposes, a "cold" tire is one that has been parked for at least three hours or not run more than three miles after sitting for three hours. Probably very few tires are ever kept at recommended inflation pressure all the time, which by itself is another reason it's amazing tires deliver the mileage they do.

DRIVER

THE
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FOR THE MILITARY DRIVER

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HQ AIR FORCE INSPECTION AND SAFETY CENTER
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JAN

VOLUME 14 NUMBER 7

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INCORRECT ISSUE NUMBER
SHOULD READ ISSUE 8

THE EDITOR SPEAKS

DOUBLE CLUTCH

MOTORCYCLE ACCIDENT PROBE COMPLETED

Regular readers of DRIVER may recall some of our articles about a four-year study of motorcycle accidents in the Los Angeles area being conducted by the University of Southern California Traffic Safety Center. The government-funded program was under the direction of Dr. Harry Hurt, who believed that motorcycle accidents were not being properly investigated and reported because the people doing those jobs were not riders. Everyone working on the USC project — from physicians to psychologists to specialists in highway design — was an experienced rider.

The study, which is now completed, involved a great deal of work: In-depth investigations of 900 motorcycle accidents, and review of police reports of 3600 cycle accidents. Some of the conclusions:

- Riders who do not wear helmets triple their risk of death.
- Nearly half of the accident victims had less than six months experience with the particular motorcycle.
- More than 90% of the riders involved in accidents had no formal or professional training in motorcycle riding.
- Alcohol and drug use by the rider was involved in 43% of fatal accidents.

The report suggests countermeasures such as high-visibility clothing for riders and high-visibility colors for the cycles, the use of protective equipment to reduce the severity of injuries, and good operator training.

Talking to us about helmets last year, Dr. Harry Hurt said "Now, the guy that wears a full-face helmet, even a $20 one, is a lot better off. Remember, the typical accident we see is the boy wonder cruisin' down the street and hitting a left-turning car at an intersection. He vaults over the car and lands on his head and shoulder. If he lands on his chin and isn't wearing a full-face helmet, his jaw is thrust back, possibly splitting the skull or severing the brain stem. A full-coverage helmet can help prevent this type of injury."

A comment Dr. Hurt made in the course of an interview for the December 1978 issue got us some of the most interesting mail of all time. In explaining how the in-depth studies were begun at the accident scene, Harry said, "Now, one of the first things we look for is the number of tattoos the victim has." That one really got to a lot of our military riders, who weren't appeased by Harry's subsequent explanation that tattoos are indications of a risk-taking personality. Says the out-spoken Dr. Hurt, "This isn't a blanket condemnation of people with tattoos, it's just the plain truth!"

Copies of "Summary and Results: Motorcycle Accident Factors Study," are available free from the General Services Division, National Highway Traffic Safety Administration, 400 Seventh Street, S.W., Washington, D.C. 20590. Although not written in the colorful language of Dr. Harry Hurt, more's the pity, the paper will be interesting to those of you working with motorcycle safety and training programs.

get no respect

continued

A rolling tire is subjected to three basic forces: centrifugal, acceleration and deceleration. The first force is because of rotation, the remaining two forces are because of paths of travel. Although it's not readily apparent a tire doesn't travel at the same speed throughout each revolution. For example, a car that is moving at 55 mph is on tires that are standing still at one point, moving less than 55 at other points and faster than 100 mph at still other points.

Ideally, when the tread is flat on the road surface there should be no motion between the tread and surface: the tire rotational speed at the instant of contact with the road surface is zero, regardless of the vehicle's speed. The point of the tread exactly opposite the zero mph point is traveling at twice the speed of the vehicle, or in this example, 110 mph.

This means the tire accelerates from 0 to 110 mph after leaving the road surface and then decelerates from 110 mph to 0 at contact again each revolution. These are referred to as the trailing edge and leading edge, respectively. Therefore, the tread material must be uniformly stiff or tire wear will be upset. A tread with hard or soft areas will respond accordingly at deflection, and tread wear will suffer.

As the tire rolls the casing flexes around the footprint, setting up a traction wave at high speed behind the footprint. The size of the traction wave varies with the amount of flex. Although the use of belted construction has reduced traction waves, all the waves cannot be eliminated in design and production parameters.

Incorrect (excessive) camber can accelerate tread wear. Camber is the amount the tire leans from perpendicular to the ground. Too much positive camber (leaning away from the car) causes rapid wear on the outside of the tread while too little camber (or too much negative camber: leaning in toward the car at the top of the tire) causes rapid wear on the inside of the tread. However, it takes a

continued

continued

whole lot of incorrect camber to cause rapid tread wear.

When the tread wears on both shoulders and the inflation pressure has been kept reasonably accurate, it could be caused by the tire "sideslipping" across the pavement — you've been driving around corners too fast.

Front wheels are toed in (the distance between the centers on the front of the two tires is less than the distance between the centers on the trailing edge) to preload the tolerances of the steering linkage and the compliance in rubber suspension bushings when entering turns. Nevertheless, incorrect toe adjustment is probably the single biggest thief of tire tread material.

A visual, or feelable, trailing flap of rubber at each tread groove area is a dead giveaway that the toe-in isn't right. Such a wear pattern is called feathered edge or sawtooth. If you run your hand over the tread towards the center of the vehicle and feel sharp edges, the wheel is not toed in enough. If you feel the same thing as you move your hand out, the toe-in is too great.

AFTER THE SALE

You've just bought another set of tires. While they're being mounted you can also make a small but extremely important purchase — a tire gauge. After making sure you know how your new gauge works, check your new tires.

Also, while you're waiting you can discuss what tire damage to look for. It's a little late to be talking about buying only the right tire for the particular application; unless you have another vehicle to re-shoe.

Cupped, dished, or scalloped tread wear is produced by a combination of mechanical problems such as loose ball joints that can allow camber to change slightly by first loading one side of the tire and then the other. Loose shock absorbers that permit the wheel/tire assembly to hop (bounce up and down) while rolling on an uneven road, loose tie rod ends, loose idler arm bushings, etc., can all cause a flat spot to develop on the tread surface which aggravates wheel hop and imbalance.

Wheel imbalance and excessive lateral and/or radial runout (out of round) will upset normal tire tread wear. Once a tire has developed a flat spot because of imbalance, mechanical or runout problems, no balance procedure will correct the problem. There are some tire truing procedures where rubber is actually trimmed off the tread and that can make the tire reasonably round again so that it will accept and hold a balance.

Excessive wheel or tire runout requires replacement of the defective unit. Wheel runout should never exceed .045 inch while tire runout should be limited to less

than .050 inch.

Some tread patterns are more sensitive to developing scalloped wear than others. If the tread features lateral ribs at the shoulders, the forces of cornering, acceleration and deceleration can quickly wear away a spot or two and encourage further scalloping.

Bias ply tires characteristically display a rapid wearing of the second rib in from each shoulder of the tire. This is the nature of the beast and can't normally be corrected by inflation, balance, alignment, etc. The best answer to holding down second rib wear is proper maintenance that includes periodic tire rotation.

Your safety and the safety of your loved ones is riding on your tires. If the tires aren't gripping the road as they were designed they aren't going to perform for you. And wear patterns can tell you when the tires are or aren't performing. Remember, your vehicle's acceleration, mpg, cornering, steering response and braking all depend on the tires and their condition. Don't let yourself down by not respecting the job tires do for you. Tires spell safety.

DRIVER wishes to thank the following for making these tire articles possible:

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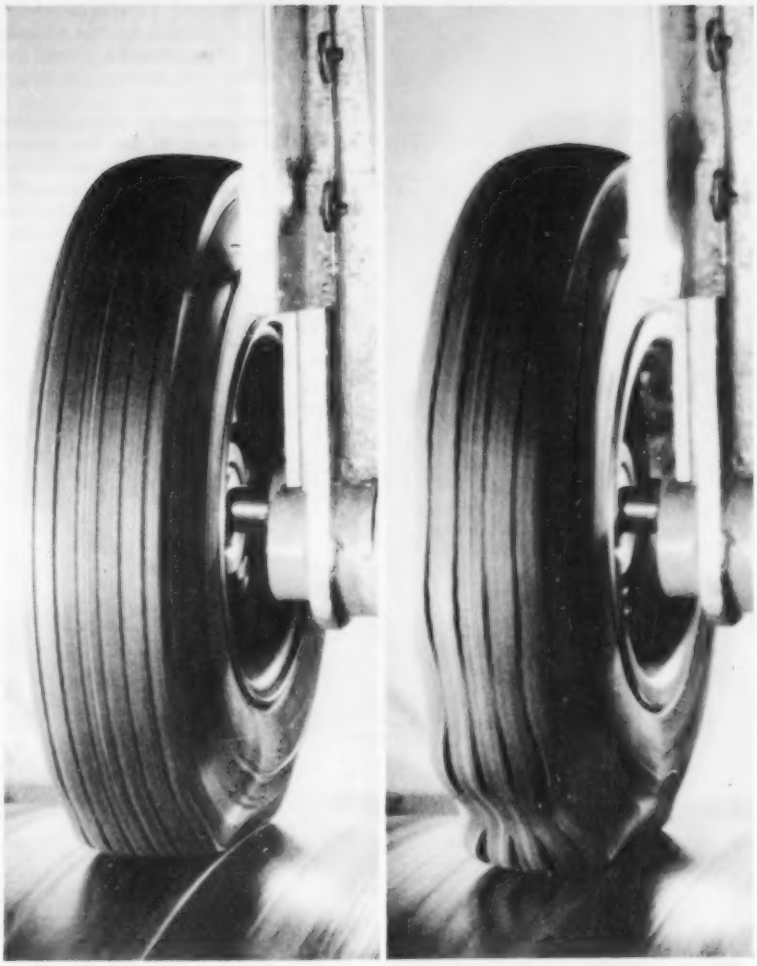
Euro-Tire, Inc



Using belted construction has greatly reduced traction waves, as can be seen in the belted tire on the left and the bias-ply tire on the right.

A tire technician completes final preparation for conducting a rolling resistance test on a General Tire radial. This high-priority test measures the force required to move a tire under load.

"Tires! Tires! Tires! It's going to cost me an entire mid-month paycheck for a new set and you expect me to smile!!!???"

Well, not really. But when you consider that the price of tires has gone up only about one-quarter the price of other consumer goods in the last few years, you should be thankful the pain isn't worse.

Now, before you go shopping let's discuss tire construction, mixing, profiles, tubeless versus tube type and markings.

There are three basic types of tire construction: bias ply (cross ply), belted bias and radial ply.

Bias-ply tires are constructed with the cords in the plies running from bead to bead at an angle to the centerline of the tire. This construction consists of two, four or more (even number) layers or plies placed on top of one another in alternating directions. This design provides strength and rigidity in the sidewalls.

The cords in the body plies of belted bias tires are arranged in a criss-cross pattern as in the conventional bias ply construction. In addition, two or more layers of fabric called "Belts" are applied directly under the tread with a different cord angle from the body plies. This design provides added stiffness and increased strength in the tread.

TIRE BASICS

Tire engineers are turning more of their attention toward the effort to reduce the noise a tire makes. This 35-foot-square room creates a near echoless environment, allowing engineers to evaluate tire noise without picking up extraneous sound.

(left) **A Firestone scientist** "talks" to a computer through the keyboard in this specially instrumented test car. The rolling laboratory is part of research and development programs aimed at continuing improvement in tire design, construction and quality. (right) **A strip of whitewall rubber** is checked for dimensional accuracy as it is stripped from a mill. Special brighteners are mixed in the white rubber compounds to make the whitewalls on the newest tires whiter and easier to clean.

Radial ply tires have cords in the body plies running from bead to bead perpendicular to the centerline of the tire and may be arranged in one or more plies. Between the radial plies and the tread are one or more belts whose cords run at a small angle to the centerline of the tire. This design provides flexibility in the sidewalls and strength and stiffness in the tread.

As a bias ply tire rolls, the plies flex against each other producing heat. The hotter a tire runs, the faster it wears. Flexing also occurs in the tread, causing it to squirm and scuff against the road surface. The flexing of the tread also distorts the tread as its grooves open and close. Closed grooves do not allow water to escape from under the tire, causing loss of traction in the wet. In cornering, one side of the tread lifts off the road as the tire has a tendency to roll over on its side.

The added stiffness of belted bias tires in the tread helps to reduce heat buildup and squirm. Belted bias tires generally deliver better tread life than conventional bias ply tires.

On the other hand, radial ply tires with their highly flexible sidewalls, together with the belts, keep their tread flat on the road surface, even in hard cornering. There is less squirm and the tread grooves remain open for better drainage on wet surfaces. The belts provide added resistance to punctures, cuts and bruise breaks. Since the body plies do the flexing (but not against each other as in the bias and belted bias constructions) almost independently of the tread, the radial tire runs cooler and with less rolling resistance. Less rolling resistance results in better fuel economy.

Radials generally deliver significantly better tread life than bias ply and belted

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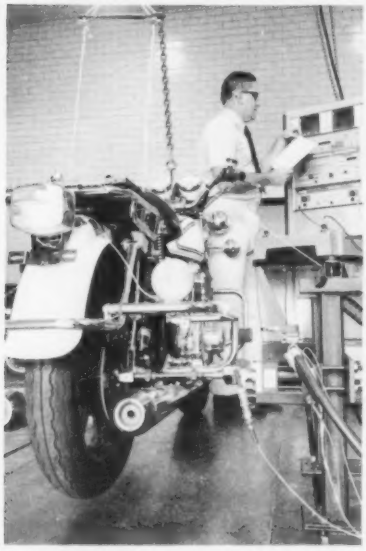
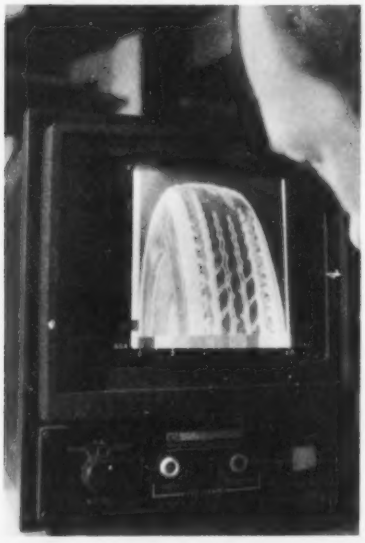


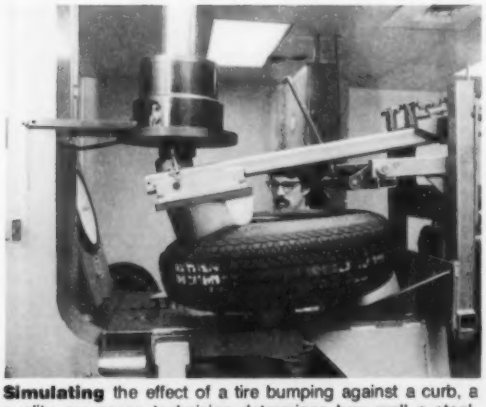
A machine at a Goodyear laboratory builds in the vibration of a motorcycle ride without rolling a tire. Using the simulation, engineers can work to eliminate undesirable conditions.

Inspection by skilled employees is one of the more than 1,000 checks and tests made throughout tire production. Inspectors carefully examine the inside of the tires as well as the tread and bead area.

(left)
To test resistance to impact damage, a quality assurance technician plunges a specially tipped steel rod into an inflated steel-belted radial tire. The high-strength construction features of radials and their higher permissible inflation pressures combine to reduce rolling resistance, leading to increased gasoline mileage.



Thermovision analysis of tires running on road wheels shows heat buildup on tire surfaces and assists engineers in designing tires that resist heat, the greatest enemy of tire life.

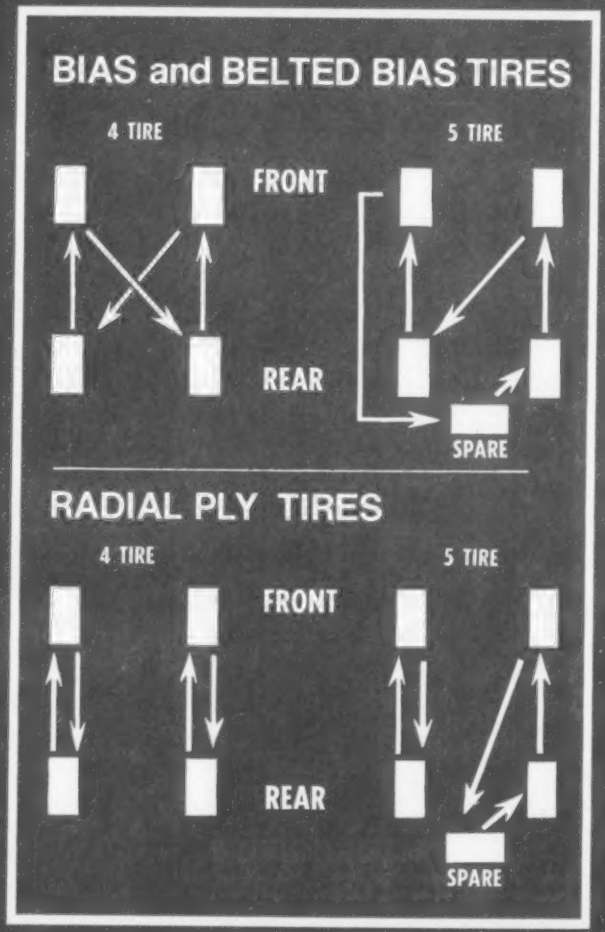


Simulating the effect of a tire bumping against a curb, a quality assurance technician determines how well a steel-belted radial tire will stay on a wheel.

A steel radial truck tire undergoes x-ray examination to inspect for internal uniformity and precision placement of components.

Radial tire construction features several belts over body ply running perpendicular from bead to bead.

(right)
Tire rotation



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bias tires. The auto enthusiast and safety conscious driver agree that the radial's real advantages are its superior handling characteristics.

For the most safety and best performance, all four tires should be of the same construction, preferably of the same brand and model. However, the process of changing types of tire construction is often done two tires at a time. If this is the case, certain care should be exercised:

■ Never mix tires of different construction on the same axle. Always mount in pairs.

The following rules must be applied, even on front-wheel-drive vehicles:

■ Don't fit bias or belted bias tires on the rear axle if radial ply tires are fitted on the front axle.

■ Don't fit bias ply tires on the rear axle if belted bias tires are fitted on the front axle.

The terms "aspect ratio" and, more commonly, "series" refer to a tire's cross-sectional profile. A tire with an aspect ratio of 78 (78 series) has a cross-sectional height-to-width ratio of approximately 78 percent. This ratio is often part of the tire size code, and where it isn't part of the code, the aspect ratio or series is implied.

The trend in passenger car tires has been from a relatively high, narrow cross-sectional profile to a low, wide profile. However, if you are considering replacing your original-equipment-size tires with a wider profile size, we recommend that you first determine that your vehicle has the necessary fenderwell and suspension clearances to accommodate wider tires and that your wheels are wide enough to safely accommodate the new size.

Tubeless tires are designed to be relatively air-tight. The beads form a seal against the wheel rim. In addition, tubeless tires have a nonporous inner liner made of a rubber compound which helps to slow air leaks caused by punctures.

Tube-type tires are not air-tight and therefore require an inner tube.

Some tires are made only in tubeless or only in tube type; others are available in both constructions. We recommend tubeless applications on safety rims only to prevent the possibility of rapid air loss in hard cornering. If you plan to fit tubeless tires (without tubes) on a vehicle originally equipped with tube-type tires, first determine that your rims are acceptable for tubeless application. Some wheels, particularly alloy ("mag") wheels are porous and will not hold air.

Radial tires that need tubes require radial tubes. It is permissible to fit tubeless tires with tubes.

The data molded into the sidewalls of all passenger car tires must conform to the regulations of the U.S. Department of Transportation.

SIZE

Example: GR78-15 (American alpha-numeric designation)

G Load-carrying capacity. The letter designation replaces the older designation of approximate cross-sectional width as in size 8.25-15.

R Radial ply construction.

78 Aspect ratio (series)

15 Rim diameter in inches.

Example: 195/70HR14 (European metric designation)

195 Approximate cross-sectional width in millimeters.

70 Aspect ratio (series). Where the aspect ratio is not part of the size code (for example, 175HR14), an aspect ratio of approximately 80 is implied.

H One of three speed ratings indicating the tire is capable of sustaining high speeds as follows:

SR up to 113 mph (except SR mud and snow tires and reinforced tires)

HR up to 130 mph

VR over 130 mph

R Radial ply construction

14 Rim diameter in inches

LOAD RANGE

The load range letter identifies maximum load and inflation limits. Maximum loads vary according to tire size. The maximum inflation pressure for load range B is 32 psi, C is 36 psi, and D is 40 psi.

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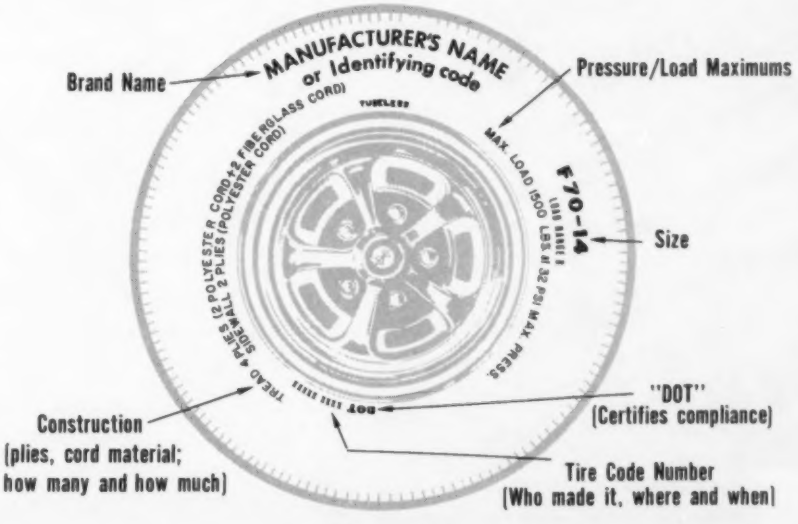

Brand Name
MANUFACTURER'S NAME or Identifying code
Pressure/Load Maximums
Size
"DOT" (Certifies compliance)
Construction (plies, cord material; how many and how much)
Tire Code Number (Who made it, where and when)

Tire markings

NOT for highway use

Although many auto tire engineering concepts have been proved in racing and auto tires have even raced in competition, it's still important to get the round peg in the round hole. The very best high-performance auto tire is seconds-a-lap slower than a pure racing tire on the track. A racing tire on the street is like a duck out of water — not to mention illegal.

"Each of our racing tires is stamped 'not for highway use' because they do not meet the Department of Transportation (DOT) standards for such use," said Gene Wall, manager of Goodyear racing tire engineering.

But beyond that it simply is unsafe to use racing tires on the street.

"The same tire that is tough enough to safely carry Richard Petty's 3,700-pound stock car around the Daytona International Speedway at 200 mph can't handle the hazards encountered on the street," Wall said.

For starters, all racing tires intended for dry track use are "slicks." They lack the auto tire's water-dispersing tread grooves — they're perfect for maximum contact with a dry surface, but a slipping, sliding, hydroplaning nightmare in the rain. On the other hand, racing rain tires feature high-speed water-dispersing tread patterns. But the rubber compounds in rain tires are so soft that they overheat and blister when driven hard on a dry track.

"Each racing tire we design is for a specific purpose," said Wall. "Racing tires are not even interchangeable for different racing conditions, let alone for street use."

However, the concepts tire engineers learn in racing are translated into auto tire technology and motorists do benefit. "There simply is no tougher test than the heated competition of motor racing to bring out the high technology that wins races and can produce advanced auto tire designs at the same time," said Wall.

Such auto tire features as the wrap-around tread, contoured tread shoulder, heat-resistant carcass compounds, new fabrics, reverse molding, low-profile, bias-belted construction, improved traction/wear characteristics and better wet weather compound and tread all emerged from the race track.

The tread pattern on Goodyear's ultra-high-performance Wingfoot Radial auto tire, for example, is derived from the company's extensive Formula 1 rain tire technology. An "Ultra-Tire Test" conducted by a leading U.S. automotive publication found that the top-ranked Wingfoot's "Formula 1-inspired tread design is so effective at shedding water that we measured the same cornering limit on both wet and dry pavement with this tire." While it's true the Wingfoot Radial is not designed to outperform a racing tire in the wet, it does offer one distinct advantage — many thousands of miles of tread life under a variety of road conditions.

"Racing tire treads, whether for wet track or dry, are compounded of the softest possible rubber, designed for maximum traction in return for considerably less than the 40,000 miles of tread wear motorists have come to expect from their auto tires," said Wall.

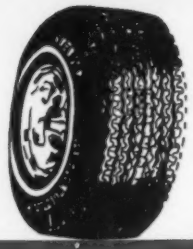
Not only that, racing tires are designed with thin treads and a minimum of sidewall protection. While these construction features better dissipate heat generated at racing speeds, they make a racing tire extremely susceptible to curb and chuckhole damage, weathering and oxidation caused by exposure to ozone and heat.

Slick racing tires should never be used on the highway. They are not safe for street use.

((right)
Production auto tires have proved themselves with shaved treads in long distance races. However, the race tire is unbeatable on the race track while the only tire for the street is a street tire.

Mark
Lieb
AGP 500
DISC BRAKE PAD
GOODYEAR

air up



Even with gasoline prices approaching $1.50 and more per gallon, most American drivers continue to waste fuel by not putting enough air in their tires. Most new cars are equipped with radial tires designed for higher air pressures, but drivers tend to follow past practices which means they aren't getting the full gas-saving benefits of the radials.

Underinflation, a longstanding problem, is even more important now as it further decreases fuel efficiency. Studies have shown that one in four tires is inflated four or more pounds below recommended minimums. And the minimums have been moved up.

From the standpoint of air pressure, many drivers generally haven't crossed the 30-pound standard yet. They still remember the 24- to 28-pounds-per-square-inch (psi) recommendation that used to be typical. But the owner's manuals for many new cars now recommend tire air pressures up to 35 psi. The P-metric radials introduced in 1978 are built for a maximum pressure of 35 pounds, and to make optimum fuel efficiency the P-metric radials must be kept at that pressure. More air pressure reduces tire rolling resistance, which in turn improves gas mileage because five to 10 percent of the fuel is used to overcome tire rolling resistance.

Tests at steady highway speeds show that four radials inflated to 35 pounds will deliver four or five percent better gas mileage than an identical car with four radials inflated to 20 pounds. These tests indicate that with radials, fuel efficiency rises about one percent for every four pounds of pressure. And compared with bias-ply tires, radials offer even greater fuel savings. P-metric radials inflated to maximum pressure can increase mileage up to 10 percent compared with bias tires inflated to their normal operating pressures.

There are three basic tire care recommendations for optimum fuel efficiency:

- Add as much air as needed to bring pressure up to the maximum indicated on the tire's sidewall. If pressures recommended by the vehicle manufacturer are different on front and rear positions, it's a good idea to maintain that differential.
- Check air pressure with a gauge at least once a month when the tires are "cold" — that is, when they have been driven a mile or less or if they have been idle for at least three hours. A good time for such a check is in the morning before your car has been driven. If the check shows, for example, that your tire is six pounds underinflated and you then drive a few miles to an air pump, take another pressure reading (because the tires will now be warm) and then add six pounds to that pressure.
- Don't release air under the assumption that continuous highway driving at speed-limit levels will increase air pressure unduly. A properly inflated tire will not overheat if driven at safe speeds. Releasing air will increase operating temperatures and could cause a tire failure.

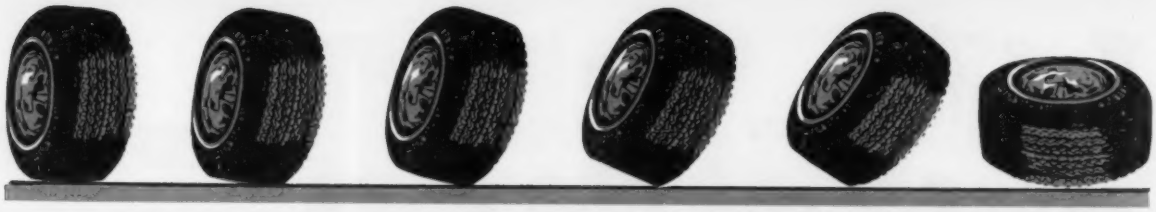
want to get 5,700 miles per gallon?

That's what an average radial auto tire gets from every gallon of petroleum needed to make it — double the "product mpg" of bias ply tires.

Chemists say that about seven gallons of crude oil are used in the manufacture of an average auto tire, regardless of the type. Five gallons are consumed in the actual materials — synthetic rubbers, tire cord, carbon blacks and other chemicals — and two gallons are used to produce the energy to assemble and vulcanize the tire.

If a motorist gets the anticipated 40,000 miles from a radial auto tire, the tire will have stretched its petroleum base to 5,714 miles per gallon. With a bias-ply tire, which can expect about 20,000 miles of service, the mpg would be only 2,857.

Radials also can add to the fuel efficiency of a car, improving gasoline mileage by an average of three to five percent over the life of the tires.



Although the tire on the right looks almost identical to its neighbor it may wear only half as long because at 16 psi it is underinflated by 33 percent.

Life—on the TREAD

The tread life of a radial auto tire means a lot more than 40,000 miles to a tire designer. It is a delicate balance of many factors.

The average new radial auto tire has about 9/32nds of an inch of useable tread depth, but how many miles that approximately quarter-inch of rubber will provide depends on how the engineer deals with each parameter.

While the design engineer has control over a lot of factors, he must take into consideration many over which he has no control. Things such as the road texture, hills, curves, straightaways and banking of roads, average temperatures, weather, speed, braking, load, inflation and rotation are a few of the factors that determine whether a radial tire reaches or exceeds 40,000 miles.

To counteract the car-road factors, engineers have three major areas of direct control — tread compound, tread design and reinforcing materials.

The compound is the formulation of the rubber — types and amounts of chemicals, types of strengthening carbon blacks, oils and vulcanizing systems.

In the tread design, engineers analyze tread patterns, width of grooves, geometry of the designs, skid depths, aspect ratios and the physical dimensions.

Fabric engineers work with the designers to determine the cord size and amounts, cord angles, number of plies and belts and how each will be placed into the end product.

When all of this input is combined into a tire, the goal is to have it compete successfully with the tire wear factors of the road, car and driver. The tire wins most but loses some. Many radials run 60,000 miles or more because the vehicles and tires are maintained correctly. Some even go 100,000 miles. On the other side, tires used in Hawaii, for example, wear unusually quickly because the aggregate in most highways there is lava, which is very abrasive.

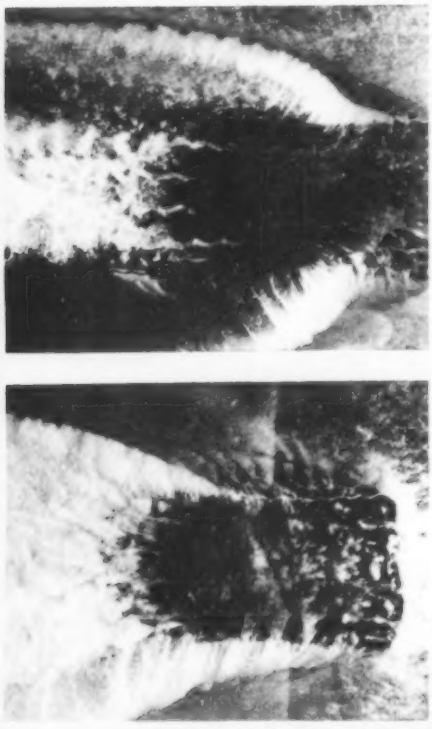
Perhaps the single most important factor in achieving the potential mileage from tires is the driver. Hundreds of miles of treadlife can be ground away in one screeching, tire-spinning start. A tire that has been engineered to last 40,000 miles can be destroyed in a matter of minutes or it can provide years of trouble-free service. It all depends on the driver and how he or she uses the tire.

To realize full potential tire life, tires should be rotated as recommended in the car owner's manual. If the manual is not available, rotate the tires every 6,000 to 8,000 miles. The first such rotation is the most important one in setting the stage for long, even tread wear. If irregular wear begins to develop, rotation is advisable before the recommended mileage interval. Earlier and more frequent rotation may also be desirable due to differences in tread wear between front and rear tires.

However, owners of front-wheel-drive automobiles may eliminate the rotation and in the process may stretch the life on radial tires on the rear wheels up to nearly 100,000 miles.

"Unless excessive irregular wear patterns develop on either front or rear tires, rotation can cost you treadlife and generally is not recommended," says Joseph T. Musteric, manager of radial auto and race tire engineering at Goodyear, in speaking of front-wheel-drive vehicles.

When radial auto tires on a front-wheel-drive car are rotated front-to-rear at regular intervals throughout their life — as they should be on rear-drive cars — Goodyear tests show they will wear out sooner than if they were not rotated. In tests con-



(left)
Hydroplaning occurs when water will no longer funnel out from under a tire through the grooves, leaving the rubber in contact with the surface. The tire at the top is still touching the road at 49 mph while the one below is not at 77 mph. Similar patterns occur with worn tire.

ducted by Goodyear on front-wheel-drive automobiles, the company's Custom Polysteel radial tires, standard equipment on many U.S. cars, averaged a projected 37,000 miles on the front and about 95,000 miles on the rear.

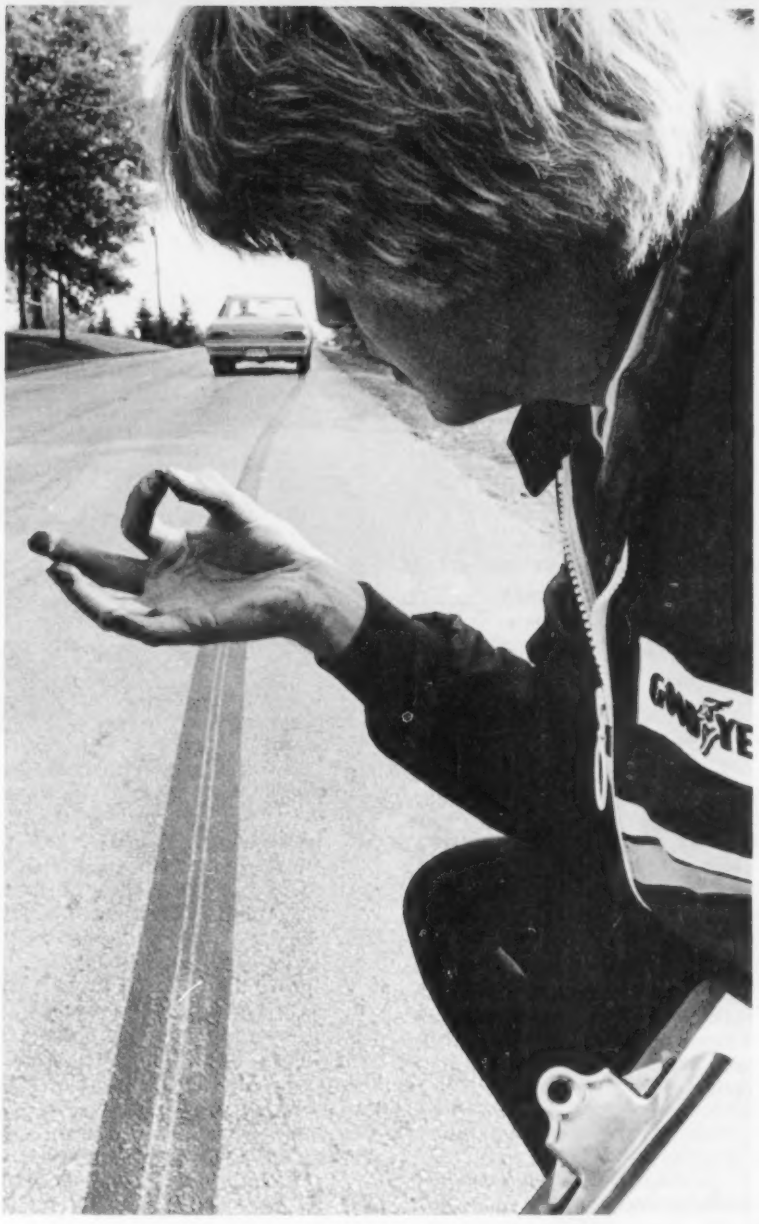
Not only do the front tires on a front-wheel-drive vehicle provide the driving torque, they also handle the functions of steering, stopping, accelerating and cornering, all at higher loads. The rear tires, because of their lighter load and free-rolling function, simply loaf along and tend to wear much longer.

If when new tires are purchased they are placed on the front wheels, the rear tires probably will last the life of the car.

Meanwhile, in a recent Firestone survey of passenger car tires removed from service for all reasons, it was found that 25 percent had been worn down to the point of being 40 times more likely to blow out or go flat than new tires. The tires had been worn down below their tread wear indicators — a potentially dangerous practice because 90 percent of all tire trouble occurs in the last 10 percent of tread life. Many people are simply using their tires longer then they should.

In the survey, Firestone made an inspection of a random cross-section of 4,500 tires at the locations where they were removed from cars in four American cities. Approximately 1,125 of them were worn down below the tread wear indicators, which appear as smooth bands running horizontally across the tire tread pattern. There are eight of these indicators per tire. They appear when there is only 2/32nds inch of tread remaining.

According to a study conducted by the Northwestern University Traffic Institute, tires with less than this amount of tread are about 40 times more likely to go flat or blow out than new tires.



A technician picks up bits of rubber left behind after a screeching start. The tire has lost perhaps 1,000 miles of useful treadlife in this single wheel-spinning acceleration.

Bald tires also increase the risk of skidding. On wet smooth pavement, the risk of skidding is about twice as great with bald tires as it is with tires of average tread depth. And skidding is already up to five times more likely with average tread depth tires on wet roads then on dry roads. A bald tire can "hydroplane," or lose its ability to channel water away from the tread, because of the absence of the tread design.

In 39 states, the operation of bald tires is not only unsafe, it's also illegal

continued

continued

because they have minimum tire tread depth laws. States with such laws are:

Alaska	Nebraska
California	Nevada
Colorado	New Hampshire
Connecticut	New Jersey
Delaware	New York
Florida	North Carolina
Georgia	Ohio
Hawaii	Oklahoma
Illinois	Pennsylvania
Indiana	Rhode Island
Iowa	South Carolina
Kansas	South Dakota
Kentucky	Texas
Louisiana	Utah
Maine	Vermont
Maryland	Virginia
Massachusetts	Washington
Michigan	West Virginia
Minnesota	Wisconsin
Mississippi	

Any tire dealer or store can measure your tire's tread depth with a special gauge, or you can do it yourself with a penny. Place the penny with Lincoln's head upside down and facing you into a tread groove. If you can see the top of Lincoln's head or beyond it, replace the tire.

Wearing a tire down too far also wastes a valuable resource — the tire casing. If a tire is worn down too far, it cannot be retreaded, a process that takes about two gallons of crude oil versus seven for a new tire.

Tread wear indicators appear in tread grooves of worn-out tires and blend with tread ribs to form half-inch bands across the tread. When the bars show up on two or more adjacent grooves, the tires are unsafe and should be replaced.

HYDROPLANING

Hydroplaning means that the tires ride like skis on top of the water instead of making proper contact with the pavement. When this happens, traction, steering and braking suffer dramatically.

Bald or severely worn tires invite hydroplaning. The tread grooves on these tires either have disappeared altogether or have reached a point where they are unable to channel the water properly between the tread and the road. So as the car gains speed, the water actually raises the tires off the road surface.

Underinflated tires also can cause hydroplaning because without sufficient air pressure, the tread grooves may close up at higher speeds.

LETTER FROM

USAF Arctic Survival

TRAINING SCHOOL

TO: The Editor, DRIVER Magazine

1. The instructors here at the U.S. Air Force Arctic Survival Training School read your article, *Snow Bound*, with a critical eye to its content. We feel the article was timely and the information pertinent to a number of Air Force personnel and their dependents. Each year, at Eielson AFB and the local community of Fairbanks, we talk to over 7,000 personnel on preparation for cold weather and emergencies, as discussed in your article. As you probably realize, the information is applicable to Alaska and to the lower 48 states as well.

2. We would like to offer, not a critique of the article, but some information that may be helpful, and add some little-known facts about cold that we teach at our school.

a. Survival Kits: Prior to beginning an automobile trip in the winter a person should dress for the worst possible conditions that might be encountered enroute. Dress as if your car did not have a heater; then, remove and place the unneeded clothing safely inside the car where it can be grabbed quickly. If the worst happens, you will have the required clothing close at hand. The survival kit must be easily accessible. If it is placed in the trunk, it may not be accessible if injury occurs or the vehicle is severely damaged or catches fire.

b. Shelters: An automobile is an appropriate "immediate-action" shelter if the environment is so severe that it is a danger to the survivor. A car will provide protection from wind chill, but without a heat source (heater, candles or sterno stove), the car will be just as cold as the outside. This is due to the relatively poor insulation in automobiles in addition to the cold conductivity of glass and metal. The victim may have a better chance for survival by erecting a shelter alongside the auto, using it as a wind break.

c. Placing ice or snow in a rag next to the body (to melt by body heat for water) is not a good idea. This procedure can cause local frostbite and promote hypothermia. It will also dampen clothing, thereby destroying its insulation properties. Wet clothing conducts heat away from the body 240 times faster than dry clothing. Nor is it wise to place snow/ice in the mouth to melt since it will be at the same temperature as the outside and can quickly frostbite the mouthparts. A better procedure is to place ice or snow in a water-proof container. Place this container beneath the outer layers of your clothing but not next to the skin where it will eventually melt to water without causing frostbite or getting the clothing wet.

d. Frostbite: Thawing of deep frostbite should be done by rapid rewarming immersion in water at 100° to 104° F. However, this should be done only when further freezing is no longer a problem. Extreme pain and shock results from rapid rewarming of frozen areas. Once thawed, the victim will be helpless and more susceptible to additional frostbite and hypothermia. Refreezing once-thawed areas will almost always result in the loss of that tissue. If an area is completely frozen, very little additional damage will occur if this area is left frozen until the victim receives definitive medical attention.

3. I hope that we have not clouded the meaning of your article. We felt the need to bring to your attention those items that differ from the most current procedures in the treatment of cold injuries and survival techniques.

JERRY R. ODOM, CMSgt, USAF
NCOIC, Arctic Survival Training School
Det 1, 3636 CCTW/DO
Eielson AFB, AK 99702

Winter and your Tires

Your car is stuck in mud or on a patch of ice or in snow. If your first reaction is to push the "pedal to the metal" and spin the tires free, you'll only be asking for more trouble, some of it serious.

If you abuse a tire by spinning it at extremely high speeds, it can overheat and fail. The result, in the worst instance, can be a tire failure and a shower of hot rubber capable of causing injury. At best, the tire's tread life is going to be decreased by hundreds of miles and there is risk of damaging the transmission and differential.

Heat is a tire's worst enemy. A spinning tire creates friction that produces tremendous amounts of heat. This heat combined with the high centrifugal forces produced by spinning could cause the tire to fail. Most people just don't realize how fast their tires are spinning.

Spinning your tires makes the road surface even slicker by melting snow which refreezes as ice, and it also creates ruts that give you additional problems trying to free your car. Peak traction is actually generated at very low spinning speeds. Once a tire is spinning 15 percent faster than the car is moving, you've lost maximum traction. Increasing tire speed is not going to increase traction.

To free a stuck car, briefly rock the vehicle, tow it or apply a traction aid such as sand or kitty litter.

You can head off problems in the spring by properly storing your regular tires that came off your car when the winter tires went on. It's quick and easy and it can add to tire life and performance.

Here's how:

- Never — repeat, never — store tires standing upright on their treads. Permanent flat-spotting can result.
- Lay them flat — whitewall against whitewall — in a cool, dry place. Keep tires away from electric motors, water, petroleum products and heat sources, including direct sunlight.
- If tires are stored mounted on wheels, reduce inflation pressures to about 15 pounds. Don't forget to reinflate in the spring.
- Indicate a tire's wheel position by marking the sidewall with chalk. Radial tires should be returned to the wheel positions they had when they were removed.
- Finally, remove stones from tread grooves and check tires for damage. If you're unsure, ask an expert.

When spring does roll around, it's very possible Old Man Winter, with his potholes and chuckholes, has left some gremlins behind in your car that can haunt you. The automotive service industry reports that April is the busiest month for wheel alignment and other front end maintenance work. The rough conditions of winter driving can affect your car's wheel alignment, shock absorbers and suspension system, making driving unsafe.

"We have customers who come in with bent tie rods, severe misalignment conditions, worn shock absorbers and ball joints, and even damaged springs," says Jack B. Scarcliff, director of consumer affairs for The Firestone Tire & Rubber Company. "One customer reported that two new front tires were worn to the wear bar indicators within a period of three months. It turned out that he had a bent tie rod and his car's front end was severely out of alignment."

There are several indicators of possible front end problems. For example, if the car tends to pull to the left or right on straightaway driving, the wheels may be misaligned. A driver can also feel the effects of misalignment by moving his hand along the edge of the tire tread (while the car is in a park position, of course). The tread will feel wavy. Sometimes misalignment is visible. The front tires will point slightly in or out or tilt somewhat rather than being properly adjusted.

Indications of shock absorber problems are severe body sway, front end dip while braking, and bouncing ride. Ultimately, stability in maintaining a steered path is affected and traction is reduced in skidding and sliding conditions.

Damage or excessive looseness of any suspension system parts will adversely affect the wheel alignment, cause uneven, premature tire wear and possibly result in a dangerous shimmy that makes driving unsafe. If you experience any of these symptoms, it's more than likely that you are due for a professional spring automotive check-up.

(right)
Tracks in the snow record an aggressive tread pattern.

GOODYEAR
TRACKER A/T

THE heavy SIDE

If you're into truckin', camping or any type of RV-ing, you should also be into the basics of tire applications for your vehicle. Knowing and following through with the correct application of tires is basic to vehicle safety and performance.

One of the most important factors affecting a tire's performance is inflation pressure. A recent survey conducted by the National Highway Traffic Safety Administration showed that 59 percent of the seven million campers and travel trailers on the road have tire pressures below the recommended maximum and 34 percent are loaded beyond the rated capacity of their suspension systems.

To understand inflation you must first understand the basics:

1. Air carries the load. A tire is basically an air container.

2. The larger the quantity or pressure of air contained by a tire, the more load the tire can support.

3. Tire load-carrying capacity can be increased by increasing the air pressure (which might require changing to a higher load range in the same size) or by providing a greater volume of air (changing to a larger size tire).

4. The load range letter (or ply rating) is an index of the maximum cold pressure for which a particular size tire is rated. It determines the maximum load that a given tire can support.

The two principal factors that affect the load-carrying capacity are tire size and inflation pressure. The load-carrying capacity of a tire increases with a larger tire size, even though the load range and inflation pressure may remain the same.

When you switch to a tire with a higher load range, higher inflation pressure may be used, up to the tire's specified limits. This again adds to the tire's load-carrying capacity. A higher load range does not provide additional load-carrying capacity unless the air pressure is increased.

The load range inflation limits of light trucks and recreational vehicle tires are not the same as passenger tires. They also may vary between sizes and construction types. Check load and inflation tables available at most tire dealers for comparisons.

To obtain the best performance from any tire, the inflation pressure should be matched to the tire size and the actual load carried by the tire. The most accurate method for determining the load is to have the vehicle weighed, axle by axle, when fully loaded. In cases where weighing the vehicle is not possible, you must estimate the load carried. Calculate the total weight of the empty vehicle, passengers, fuel and cargo. Empty vehicle weights are shown on the vehicle registration certificate in most states. Then estimate the load each axle supports.

You may find that the vehicle is loaded beyond the suspension limits as specified on the permanent label attached to the cab. This label has been required for all motor vehicles manufactured since January 1, 1972. It indicates the maximum gross vehicle weight (GVW) and axle rating for the vehicle as manufactured. (GVW is total weight of the vehicle, including driver, passenger, fuel and cargo.)

The axle rating is limited by the weakest component of the axle system, which consists of the tires, wheels, springs and axle. If the limits are exceeded by the load carried, a tire that will handle the load can be installed, but you may be overloading other parts of the suspension system. It may be that the tires are the limiting component, and installing a larger size or higher load range tire will increase the permissible GVW and axle rating.

After determining the weight each axle supports, divide this amount by the number of tires on that axle. Then use a load and inflation table to determine the tire size and load range required.

THE light SIDE

The light truck is the last bastion of the true high-performance vehicle in the U.S. The truck is literally anything the owner wants it to be

Tires are one of the keys to loading any vehicle, especially those used for camping.

— the maximum in functional utility, the ultimate in customization or an adult toy.

The current energy and economic crunch has had the same effect on trucks as it has on automobiles. There has been a great influx of so-called "mini" and small trucks, but many still retain their go-anywhere, do-anything capability. However, the truck, like the car, is confined in its actual performance to the tires.

The proper tires make the capabilities of the vehicle a reality. And because of the varied potential of today's light truck, the truck owner has the opportunity to "do his thing" merely by changing tires. By going to oversized tires, wide profiles or tires having traction-type tread designs, the entire purpose of the truck changes.

It is important that the vehicle owner recognize that there are some operational considerations, safety restrictions and technical limitations that must be observed when making such changes. Improvements can be made in some performance characteristics, but others could deteriorate slightly. The vehicle owner should be aware of the disadvantages as well as the advantages of the new tire size or type. In selecting a new tire, first consult the vehicle manufacturer's recommendations. For improving certain performance features, consult the tire dealer's recommendations.

Light trucks become what the owners want with applied doses of "tires to do the job at hand."

Nearing the end of a series of quality control inspections and tests, radial tires designed for four-wheel-drive vehicles are fed into a force variation machine that measures the lateral and radial responses in a rolling tire.

There are three major tire performance characteristics — cornering and stability, traction, and fuel economy.

Improvement in cornering and stability can come merely from wider rims, proper inflation for the load, use of higher load range tires or installation of larger tires on the rear axles if the truck is not a four-wheel drive.

Traction is improved more by the tread design and tread rubber compound than by increasing the tire size. As a general rule the extra-large, lightly-loaded tires have better traction on dry pavement than conventional size tires, but less traction on wet or slippery pavements. An open tread pattern with cross grooving will compensate for this loss, however. Obviously, large tires are better in mud where flotation is needed and an aggressive tread pattern provides the biting traction.

To maximize fuel economy, select tires designed for higher inflation pressures and use radial tires with conventional aspect ratios. The heavy tread mud and snow designs don't deliver the fuel economy of thinner treads.

If the tire size, type, load rating or design is being changed, there are six safety checks necessary. They are:

- Fit of the tire on the rim.
- Strength of the wheel and rim.
- Tire load ratings
- Type of service.
- Tire clearances.
- Stability of the vehicle.

Any tire is a compromise, but with a truck it is an even greater one. There are special open tread designs for the 4x4 that is going to be used heavily off the road. There are other, more closed designs for street use, and in-between designs for split use. The choice is up to the owner.

For maximum flotation and ground clearance, chassis can be raised and greatly oversized tires on oversized rims can be installed. These aggressive designs now are being developed in auto-tire sizes for the "mini" trucks, which do not have wheel well clearance for standard truck tires.

There are many "dos" and "don'ts" in matching tires with trucks. A few of the more important ones are:

- On four-wheel-drive vehicles keep all tires the same size.
- The best tire and vehicle performance usually will be obtained by applying identical tires on all wheel positions.
- Open tread patterns wear quicker on roads.
- Don't reduce inflation when going off the road. Reducing pressure when you are stuck can get you going, in an emergency. But be sure to reinflate the tires as soon as possible. Don't run underinflated on highways.
- If you plan to convert to radials, make certain the wheels are approved for light truck radials.
- Buy from a tire dealer that offers a full line of light truck tires. This gives you the opportunity to get the best tire for the purpose for which the truck will be used.
- If tire constructions are to be mixed, mount radials on the rear. If the choice is between diagonal and bias-belted, mount the bias-belted on the rear.
- Never mount a 16-inch tire on a 16.5-inch rim or vice versa.
- When in doubt about a truck-wheel-tire combination, seek professional advice. Don't guess!

someone's afoot

When a car breaks down, the driver is suddenly made an involuntary pedestrian. When this happens, he must take special care to insure he isn't hit by a car and made an involuntary statistic.

Through September of 1980, the Air Force lost eight people to pedestrian accidents. This compares to 10 members who died in pedestrian mishaps during all of 1979. Things are definitely getting worse.

Almost a third of these members we've mentioned (1979 and 1980) died in situations similar to the one our friend here finds himself in — the car breaks down, the driver gets out to check the problem or walk to a phone, and he is hit by a passing motorist.

Why do these needless accidents happen? What are the factors involved?

First of all, the time of day. As would be expected, most of the accidents (15 of 18) happened at night. Visibility is poor, and often the pedestrians are not wearing light-colored clothing, making them difficult to see.

"Airman walked into the eastbound lane and was struck by an eastbound pickup truck whose driver did not see him until the approximate moment of impact. Airman was wearing a black leather jacket and the only lighting in the area was from the headlights of the mishap vehicle . . . "

"Airman was walking along highway and walked into an off ramp and was struck by a PMV. Airman was wearing a fatigue uniform and could not be seen by driver of PMV until just prior to impact . . . "

Consumption of alcohol was another factor. Either the pedestrian or the driver (or both) had been drinking in half the accidents.

"Individual was wearing dark-colored clothing, walking west in the westbound lane of an unlighted street when he was struck and killed by a pickup truck driven by a non-Air Force Civilian. PMV operator was DWI (driving while intoxicated), with Blood Alcohol Test (BAT) of .16 percent . . . "

"Airman was the victim of a hit and run. He had been drinking heavily and was driving his car. He ran off the road into the desert. He then walked back to the road and lay down in the road. He was struck in the head by an automobile . . . "

By the way, the National Safety Council recently did a study of pedestrian accidents which showed a heavy involvement of alcohol in adult pedestrian fatalities.

"Studies of fatal pedestrian accidents have shown that half or more of the adult pedestrian victims had measurable concentrations of alcohol," the Council said. "About 30 percent of the victims had blood alcohol concentrations in excess of the 15 percent which, in drivers of motor vehicles, is generally considered to result in marked impairment of driving ability."

Beyond these things, our reports don't give us much idea of the causes of these mishaps. Carelessness,

either by the driver or by the walker, is certainly a possibility.

Or take this one for example; how could it have been avoided?

A member was "changing a tire on the utility trailer, assisted by his wife and son, when a non-USAF civilian traveling in the same direction lost control of his vehicle and slammed into the rear of the trailer, striking the three individuals . . . "

Perhaps all pedestrian accidents cannot be avoided, but we are betting that most can, if the drivers and those on foot will exercise caution. We have a few suggestions toward that end.

If your car breaks down, get it as far off the road as possible. Turn on the hazard flashers and put out warning triangles or road flares. Give the other motorists plenty of notice that you're there.

When you get out of the car, wait until there's a wide space in traffic to allow you time to get around the car. Stay away from the road side of the car, if at all possible. Many a stranded motorist has been hit while trying to change a tire on the left side of his car.

As much as possible, stay away from the car *period*. Drivers, usually drunk ones, have been known to hit parked vehicles.

Try to wear something reflective or light-colored, if you have anything. It's a good idea to carry a light-colored jacket in the car for just this purpose.

If you're forced to walk to a phone for assistance, walk as far off the traveled portion of the road as possible. Remember the careless drivers and the ubiquitous drunks. Carry a flashlight if you have one. With it, you can signal your presence to passing autos.

Be alert for the sound of approaching autos. Stop and turn toward them as they approach. You might be able to hitch a ride, but mostly you will be able to *see* what they're doing. Be ready to dodge if you see them heading for you.

Above all, don't drink to excess. Aside from making you a lousy driver, alcohol will make you an unsteady pedestrian, too.

And now a final word to drivers. When you see hazard flashers on a stalled car, or flares, or warning triangles, *expect to see people on foot.* Look for them, and be prepared to avoid hitting them.

We'll cheat and give you a couple more words. Look for pedestrians at *all* times, not just when you see a stalled car. You always scan parked cars as you pass them for drivers about to open the doors. (You *do*, don't you?) Use the same technique to look for pedestrians — scan the edge of the road.

Sooner or later, a pedestrian will be there, and he'll be very grateful if you don't run over him.

MAKING the most of MOST

A federally-funded research project in California has shown a 14 to 21 percent reduction in accidents for motorcyclists going through a comprehensive operator testing program. Comprehensive operator testing programs are one of the features offered by the Motorcycle Safety Foundation (MSF).

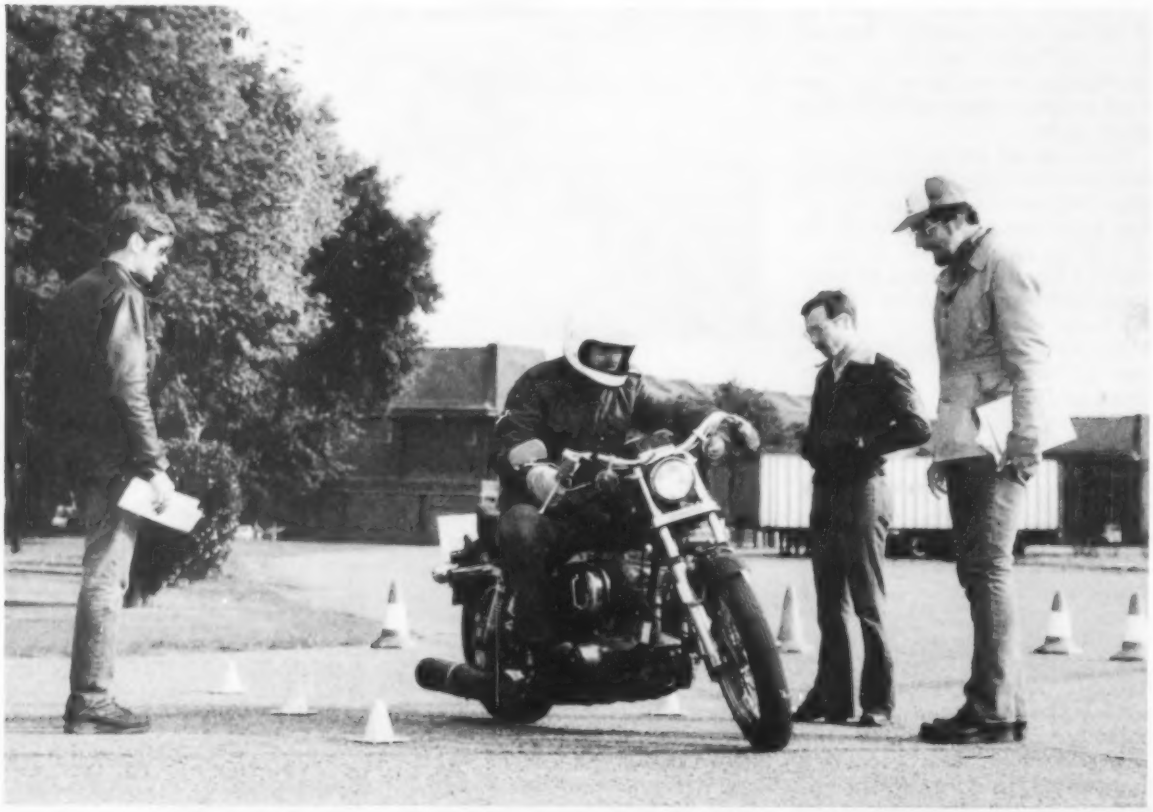
The MSF Licensing Department staff have been working with state motor vehicle officials in an effort to upgrade and improve licensing standards for motorcyclists. As the research project verifies, these efforts can make a marked improvement in motorcycle safety.

MSF licensing developments include:

- The Motorcycle Operator Manual (MOM) — a handbook for motorcyclists.
- "Sharing the Roadway" — information for inclusion in *state driver* handbooks. (You motorcyclists are applauding that one, aren't you?)
- A written knowledge test based on information from the MOM.
- The Motorcycle Operator Skill Test (MOST) and Skill Test II (MOST II) — an off-street skill test.
- The Motorcyclist In-Traffic Test (MIT) for actual in-traffic testing of motorcyclists followed by an examiner in another vehicle.

If you have ever taken a test for a motorcycle operator's license and gone away shaking your head over how useless the test seemed in proving whether you were actually a competent rider, this should offer a ray of hope.

The chart shows what licensing programs are currently in use by the individual states.



STATE	MOM ADOPTION	"SHARING" ADOPTION	MOM KNOWLEDGE TEST	MOST II	UPGRADE SKILL TEST	EXAMINER TRAINING
Alabama	Negatives sent 1980	No	No	No	No	No
Alaska	1977	No	Yes	No	No	No
Arizona	Possible 1980	No	Possible	Probable pilot	Possible	Possible
Arkansas	No	No	No	Possible 1981	No	No
California	1979	No	1979	8 sites	—	1980
Colorado	Negatives sent 1979	No	—	No	No	No
Connecticut	Negatives sent 1980	Next revision	20 slides produced	No	1981	Spring 1981
Delaware	1979	Printed 1980	1979	No	1979 Upgraded existing test	1979
D.C.	No	No	No	No	No	No
Florida	No	No	No	No	No	No
Georgia	1980	No	No	Possible 1981		Tentatively planned 1981
Hawaii	No	No	No	No	No	No
Idaho	No	No	No	No	No	No
Illinois	No	No	No	No	MIT	1977, 1978
Indiana	Possible 1981	No	Portions 1981	Possible 1981	Study 1980, 1981	Possible 1981
Iowa	No	No	No	No	1979 Upgraded test	1976, 1979
Kansas	1976	No	Possible 1980	Possible pilot 1981	Alternative test adoption 1980	1980
Kentucky	No	No	No	No	No	No
Louisiana	Possible 1981	No	Possible 1981	Possible 1981	No	1978
Maine	No	No	No	No	No	No
Maryland	No	No	No	No	1979, 1980	1978, 1979 and 1980
Massachusetts	No	No	No	No	No	No
Michigan	Negatives sent 1980	No	No	No	No	No
Minnesota	1980	Printed 1979	Upgraded 1979	Planned 1981	Upgraded 1979	Managers 1979
Mississippi	1976	No	No	No	No	No
Missouri	No	No	No	No	No	No
Montana	No	No	No	No	No	1975
Nebraska	1980	Planned 1980	Partial 1980	Possible pilot 1981	No	No
Nevada	1979	Portions 1980	1980	1980	—	1979, 1980
New Hampshire	Planned 1981	No	—	Possible 1981	Adopted alternative test 1980	1980 non-MOST and MOST refresher
New Jersey	Negatives sent 1979	No	No	No	No	No
New Mexico	1979	No	No	1980 Albuquerque	1980	1979 MOST II
New York	1979	No	No	No	No	1975
North Carolina	No	No	No	No	No	No
North Dakota	1977	No	No	No	No	No
Ohio	1977	No	No	No	Upgraded 1980	1979
Oklahoma	Negatives sent 1980	Planned 1980	20 slides produced 1980	No	MIT adopted 1978	1978
Oregon	No	No	No	No	Alternative test 1980	Managers workshop 1979; examiners 1980
Pennsylvania	1976	Portions	Upgraded 1980	No	MSF proposal for new test 1979	1977, 1978
Rhode Island	No	No	No	No	No	No
South Carolina	No	No	No	Possible 1981	No	No
South Dakota	1980	No	Partial adoption	Pilot 1980 4 sites	Alternative test adopted 1980	1980
Tennessee	1976	No	No	Possible 1981	No	1976
Texas	Negatives sent 1980	No	Upgraded 1980	No	MIT demo project awarded by NHTSA	MIT 1980
Utah	1977	No	—	1980 4 sites	1980	MOST II training 1980
Vermont	No	No	No	No	No	No
Virginia	1980	Possible	Upgraded 1980	Possible	No	1977, 1979
Washington	Negatives sent 1980	Possible	Planned 1980	No	Alternative test adopted 1980	1980
West Virginia	No	No	No	No	No	No
Wisconsin	1980	No	1980	Pilot 1980	—	1975, 1980
Wyoming	1977	No	—	No	No	1977

Key: MOM—Motorcycle Operator Manual MOST—Motorcycle Operator Skill Test MIT—Motorcyclist In-Traffic Test

continued from page 9

DOT IDENTIFICATION CODES

Example: DOT XA E9 XYZ 118

DOT This symbol certifies compliance with the safety standards of the U.S. Department of Transportation.

XA Manufacturer and factory code.

E9 Tire size code.

XYZ Group of up to four characters used optionally by the manufacturer to identify a tire model, production run, private brand or other characteristics of the tire.

118 Date of manufacture. In this example, the 11th week of 1978.

OTHER MARKINGS

- Manufacturer's name or brand logo.
- Maximum load and inflation pressure.
- Cord material and number of plies in tread and sidewall.
- "Radial," "Tubeless," or "Tube Type" where applicable.

Size Comparison Chart

Interchangeability is **NOT** implied. See note below.

CONVENTIONAL (83) BIAS PLY		BIAS AND BELTED BIAS PLY				RADIAL PLY				
1965-On	Pre-1965	'78 Series'	'70 Series'	'60 Series'	'50 Series'	Metric	'78 Series'	'70 Series'	'60 Series'	'50 Series'
6.00-13						165R13				
		A78-13	A70-13	A60-13			AR78-13	AR70-13	AR60-13	
6.50-13		B78-13		B60-13	B50-13	175R13	BR78-13	BR70-13	BR60-13	BR50-13
7.00-13		C78-13	C70-13	C60-13	C50-13	185R13	CR78-13	CR70-13		
		D78-13	D70-13	D60-13			DR78-13	DR70-13		
						195R13	ER78-13		ER60-13	
						155R14				
									AR60-14	
6.45-14	6.00-14	B78-14				165R14	BR78-14			
6.95-14	6.50-14	C78-14	C70-14			175R14	CR78-14	CR70-14		
		D78-14	D70-14	D60-14			DR78-14	DR70-14		
7.35-14	7.00-14	E78-14	E70-14	E60-14		185R14	ER78-14	ER70-14		
7.75-14	7.50-14	F78-14	F70-14	F60-14	F50-14	195R14	FR78-14	FR70-14	FR60-14	
8.25-14	8.00-14	G78-14	G70-14	G60-14	G50-14	205R14	GR78-14	GR70-14	GR60-14	GR50-14
8.55-14	8.50-14	H78-14	H70-14	H60-14	H50-14	215R14	HR78-14	HR70-14		
8.85-14	9.00-14	J78-14	J70-14	J60-14		225R14	JR78-14	JR70-14	JR60-14	
	9.50-14		L70-14	L60-14				LR70-14	LR60-14	
					M50-14					
					N50-14					
		A78-15	A70-15				AR78-15			
	6.00-15	B78-15		B60-15		165R15	BR78-15	BR70-15		
6.85-15	6.50-15	C78-15	C70-15	C60-15		175R15	CR78-15	CR70-15		
		D78-15	D70-15				DR78-15	DR70-15		
7.35-15		E78-15	E70-15	E60-15	E50-15	185R15	ER78-15	ER70-15	ER60-15	
7.75-15	6.70-15	F78-15	F70-15	F60-15		195R15	FR78-15	FR70-15	FR60-15	
8.25-15	7.10-15	G78-15	G70-15	G60-15	G50-15	205R15	GR78-15	GR70-15	GR60-15	GR50-15
8.55-15	7.60-15	H78-15	H70-15	H60-15	H50-15	215R15	HR78-15	HR70-15	HR60-15	HR50-15
8.85-15	8.00-15	J78-15	J70-15	J60-15		225R15	JR78-15	JR70-15	JR60-15	
9.00-15	8.20-15		K70-15					KR70-15		
9.15-15		L78-15	L70-15	L60-15	L50-15	235R15	LR78-15	LR70-15	LR60-15	LR50-15
		M78-15					MR78-15	MR70-15		
8.90-15		N78-15			N50-15		NR78-15			

NOTE: Interchangeability between corresponding sizes of different construction tires is not always possible due to differences in load ratings, tire dimensions, fender clearances and rim sizes, or vehicle manufacturers' recommendations.

"Neither a BORROWER..."

"Neither a borrower nor a lender be
For loan oft loses both itself and friend . . ."
— Hamlet, Act I, Scene III

Polonius' advice to his departing son Laertes bears repeating here, even though he wasn't referring to motorcycles. A cycle owner should be careful when he thinks of lending his motorcycle to anyone, because he might lose both the bike and a friend.

Here's the common (as in "all *too* common") story. A group of friends are holding a party, serving alcoholic beverages. One of the group decides it would be a good time to try out his friend's motorcycle, as he's been wanting to do for a while. He borrows the keys and takes off. He rides away and, because of the amount he's had to drink, decides to "see what this thing will do." He accelerates to far above the speed limit and fails to make a turn. He is killed and the motorcycle is totalled.

Sometimes the details are different. It isn't always the drunk who wrecks the bike; sometimes the person is sober. It isn't always as a result of speeding; sometimes it's just foolhardiness. But many, many accidents happen after a person borrows another's motorcycle. And we think unfamiliarity with the motorcycle may be the key to the problem.

"Neither a BORROWER..."

If you're thinking of asking to borrow someone's cycle you should ask yourself, "Do I really know how to handle this thing, or would I be better off if I got a little instruction?"

If that sounds too cautious, consider that riding a motorcycle is much more difficult and tricky than driving a car. Cycle riding calls upon your sense of balance, as well as the basic skills. A motorcycle is extremely unforgiving of any riding mistakes. It is best to get the owner's instruction on the particular bike, in case it has any special idiosyncracies.

You should also ask yourself, "Is this trip really necessary?" In other words, are you borrowing the bike to run an errand, or just to go on a "joy ride"? Make sure you're thinking responsibly and not showing off.

And you should ask, "What's my condition?" Alcohol seriously affects your balance, so stay off a cycle if you've been drinking. Similarly, fatigue is a bad condition for safe motorcycle riding.

"Nor a LENDER BE..."

Now some advice to owners: Those things we mentioned for the potential borrower are things you should also be concerned with. But your responsibility is greater because it is you who makes the decision to lend or not to lend.

Ask yourself these questions: What condition is my friend in? Is he drunk or sober? Is he in good enough condition to safely handle my bike? NEVER let an intoxicated person ride your cycle. Alcohol plus motorcycles almost *guarantees* an accident.

Has he ever ridden it before? Does he know about the adjustment of the brakes (or whatever)? Think about everything he needs to know to ride your cycle safely.

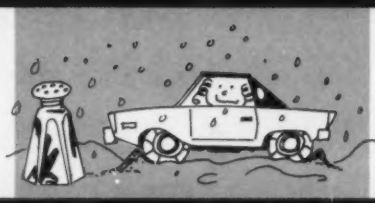
What kind of person is he, basically? Is he immature? Is he likely to take chances? You don't want a hot dog on your bike, any more than you'd want one behind the wheel of your car.

Why does he want to borrow the bike? Does he really need it, or is he just taking another friend out to impress with his riding ability? The urge to show off could lead to taking chances.

You see, a person who will let another have his way is not always a friend. A friend will not let another endanger himself. A friend will take into account all the factors and then make a wise decision — even if it isn't the choice desired by the other.

BACKfire

LETTERS to the EDITOR



DIRECT MAIL PROBLEMS

In the September "Timely Topics" column of DRIVER you gave a hotline number for Direct Mail Marketing Association for problems concerning mail orders.

We cannot call from overseas. Would you please give us a mailing address? We have serious problems with mail orders and a big volume of mail.

CMSgt Aaron Petty, USAF
APO San Francisco 96334

The address of the Direct Mail Marketing Association is 6 East 43rd Street, New York, NY 10017.

WINTER DRIVING TIPS

First, let me compliment you and the DRIVER staff for your excellent magazine, probably the definitive traffic safety magazine published, military or otherwise.

As a native of Idaho and a veteran of five Alaskan winters, the article "Snow Job" particularly interested me. I would like to add to the excellent suggestions in the article a few of my own, gathered through 18 winters' worth of cold weather driving experience.

First, the installation of tire chains for traction in snow or on ice can be critical, especially with the reduced tire clearance on some smaller cars. Tire chains installed as described in the article, using a chain applier, is good, as far as it goes. To extend tire and chain life, as well as reducing the possibility of body damage to the vehicle, chains should be installed so they fit the tire quite snuggly. There should be less than one link play in each side of the chains. Relying on a rubber or plastic "chain adjuster" to keep the chains tight is unrealistic. The centrifugal force of the chain at the maximum recommended speed of 35 mph will stretch this adjuster and defeat its purpose. When properly installed, tire chains should need no such accessory. After driving a half mile or so, check the chains on each drive wheel. You will probably find they need to be tightened by one, maybe even two links.

Second, I was glad to see you give several reasons for not letting air out of tires to increase traction. Another reason that you didn't mention is that decreasing tire pressure not only does not increase traction, but may actually decrease traction by inhibiting the tire's ability to clean its tread of packed snow.

My third point is directed to those who own or drive vehicles with a limited slip or "posi-trac" differential. Those drivers need to exercise some extra care when attempting to maintain speed or accelerate while cornering on a slick surface. Due to the nature of that type differential, both rear tires tend to lose traction at the same time, causing an exciting and treacherous skid that is difficult to recover from. While vehicles with a limited slip differential tend to accelerate more readily on a slippery surface than those with a standard rear end, they also provide the driver less warning prior to loss of traction and skidding.

Fourth, I would like to suggest that people who find chains impractical to carry or use can reduce the possibility of having to call a tow truck when they do get stuck by keeping a small sack of rock salt in the trunk. When the vehicle gets stuck, simply pour a double handful of rock salt ahead of and behind each drive wheel. After waiting a couple of minutes for the salt to soften the packed snow around the tires, gently apply the emergency brake and slowly drive out of the now slushy snow. Applying the emergency brake gently will have the same effect as the limited slip differential; it will keep one tire from spinning before the other one takes hold. One word of caution, however. You should thoroughly wash the tires, wheels and wheel wells if you plan to go anywhere within, say, a quarter mile of any aircraft. Salt, even in minute concentrations, is very corrosive and can seriously degrade the performance and service life of jet engines.

And finally, in response to the letter from Lt. Dick Benoit and his experience with cruise control and snow, it is a good policy to disengage the cruise control under any of the following conditions: 1) while in moderate or heavy traffic, 2) on snowy or slushy roads that are crowned, hilly, or both, 3) any time the road surface condition is partially covered with snow, slush, ice, or even rain, and 4) any time the driver feels that he would be safer and more responsive to rapidly changing road conditions with the cruise control disengaged. Properly utilized, cruise control can significantly reduce fatigue. When used improperly or in unfavorable conditions, it can be as frightening (or fatal) as a deadly weapon. I feel the most important component of any cruise control mechanism is the foot brake release or disengagement switch. If, for any reason, that switch is disabled or inoperative, the entire cruise control system should be considered inoperative.

Capt Robert G. Ellis, USAF
Yuba City, CA 95991

WINTER TIPS

I just finished reading the October issue and I was very impressed with your article on winter driving. Being stationed in Pensacola, Fla., we don't get to practice a lot of snow driving. However, having been raised in the panhandle of Nebraska I would like to pass on a few tips that I have learned over the years. I hope

that you and your readers will benefit from these little, simple items.

1. To help prevent windows from freezing over at night try putting some plastic over them; sure saves a lot of scraping.

2. If you keep your car in a driveway it is best to back in at night. That way in the morning you can drive forward which will allow the front tires to cut a path in the snow, providing it's not too deep. This works fine on a rear-wheel-drive car but I am not sure about front-wheel drive. (Ed Note: You want to go in frontward with the front-wheel-drive vehicle.)

3. Good old-fashioned chlorine bleach works wonders for thawing ice on the ground to help traction in case you're stuck.

4. And finally, if you do get stuck and you have forgotten the sand that you usually carry around in the trunk, try something simple like using the floor mats inside the car. Just place them directly in front of or behind the drive wheels and ease your way out.

I sure hope that this will help out. We all enjoy your magazine. Keep up the good work.

AD(R)1 R. J. Gresens, USN
NAS Pensacola, FL 32508

ROPE AND SURVIVAL KIT

First I'd like to say that I enjoy your magazine very much. It is interesting and I learn something new every time I read it.

I have a couple of suggestions concerning the two articles "Snow Job" and "Snow Bound" in your October 1980 issue. In "Snow Job," under 'stocking up, I recommend including rope as one of the items to keep in the trunk. It comes in handy and doesn't cost much. About $2 for 100 feet of cotton rope. It could also be included in the survival kit in "Snow Bound." It beats ripping wires out of your dash.

My second suggestion covers food in the survival kit. Instead of candy bars or dried fruit, I recommend carrying three or four boxes of C-rations — more or less depending on what is appropriate. I get mine at the commissary for about $3 each. This would supply food to survive and they don't spoil quickly.

That's all I've got. Keep up the good work.

SSgt Drew R. Smith, USAF
Cannon AFB, NM 88101

Speaking of the "Snow Bound" article, don't miss the letter in the front of this issue from the USAF Arctic Survival Training School. They offer some new and important information.

SNOW CRUISING

I have just read Lt Dick Benoit's "Snow Cruising" letter in the October DRIVER. I have a sister who was born in Stephenville and a brother born in Dublin (Texas), and while it has been many years ago I was quite surprised to read about enough snow in that country to create a problem.

Be that as it may, I've driven up here in the snow and ice country for the last 16½ years, used cruise control on about six different cars I've owned, and never had any trouble on snow or ice.

Perhaps his control was not properly adjusted, but I feel his six months with the car and reluctance to use the cruise control was his undoing. My cars have required only a brush of the brake pedal, nowhere near enough pressure to activate the brake shoes, to release the cruise control.

I think he, and anyone else with a like reaction, should become more familiar with the release action of the control. True, you do have to touch the pedal, which can easily be done with the left foot if the right foot is "occupied."

Mr. Jack J. Claybourn
Rapid City, SD 57701

Every driver training program we know of discourages left foot braking. Most right foot brakers will find that they can't just "touch" the pedal with their left foot but will slam it down, which could be disastrous on a slick surface. If you want to try Mr. Claybourn's technique for releasing the cruise control with your left foot, practice it in advance on dry surfaces and under safe conditions.

AFRAID OF BRAKE USE

I was just reading the October 1980 issue of DRIVER about "Snow Cruising" in Backfire and it reminded me of the accident I had in March 1976 caused by cruise control. We (my husband, mother and father) were on U.S. 23 coming home from Ann Arbor after visiting my dying brother in the hospital.

It was raining as we came up on an overpass with the cruise on. Well it had iced over and like the driver in the letter I didn't want to touch the brakes for fear of a worse skid. Well, it didn't work and we hit the overpass three times. Once scraping the right front; then doing a 180-degree spin hitting the right side again and removing the rear axle from the car; and finally ending up head-on into the guard rail.

All that because I was afraid to hit the brakes and couldn't think fast enough to turn off the control — mainly because I didn't remember it was on.

Ms Julie Hussar
Linden, MI 48451

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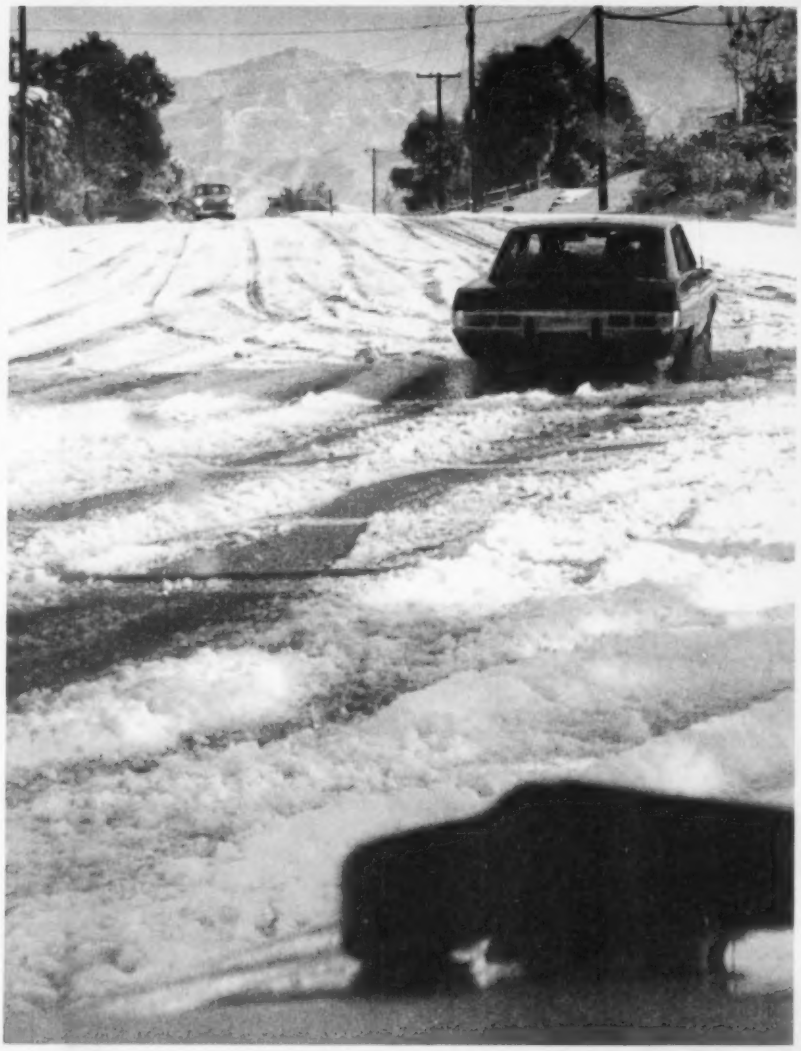
How Do I Drive On This Stuff, Anyway?



ice, water, or snow...
Drive slow
Drive in low